Ultrafast Time Domain Studies of Layer Dynamics in Smectic Liquid Crystal Films

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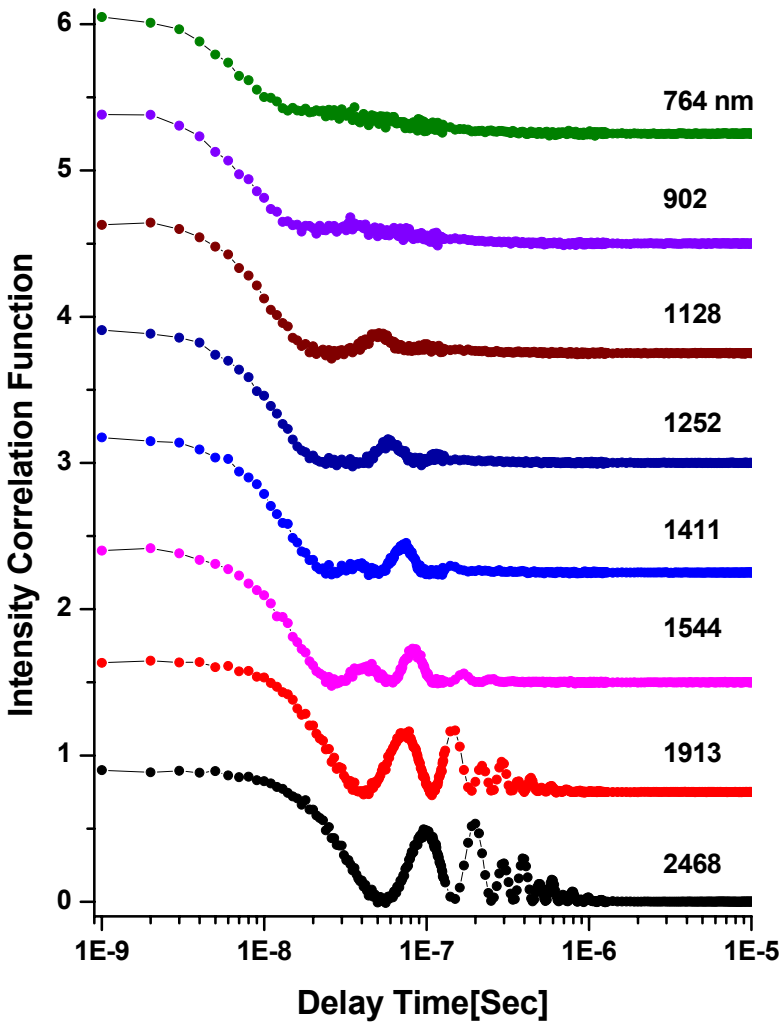
Using a custom built electronic correlator to analyze intensity fluctuations of scattered light, we have probed thermally-induced layer dynamics of freely-suspended smectic films with unprecedented nanosecond resolution in the time domain. Our measurements provide a fundamental test of the hydrodynamic theory of smectic liquid crystals and, by extension, of other soft matter systems exhibiting analogous layering.

Shown at right are intensity correlation functions of visible laser light scattered from a 130 nm thick smectic-*A* film of a standard cyanobiphenyl compound. As the wavelength of the layer fluctuations decreases (from the bottom to the top trace), one observes a predicted crossover from underdamped (oscillatory) to overdamped (purely decaying) dynamics. However, a detailed analysis reveals more complex behavior in the crossover region than contained in the simplest dynamical models.



Correlator.kent.edu: LabVIEW-based Remote Light Scattering Experiments

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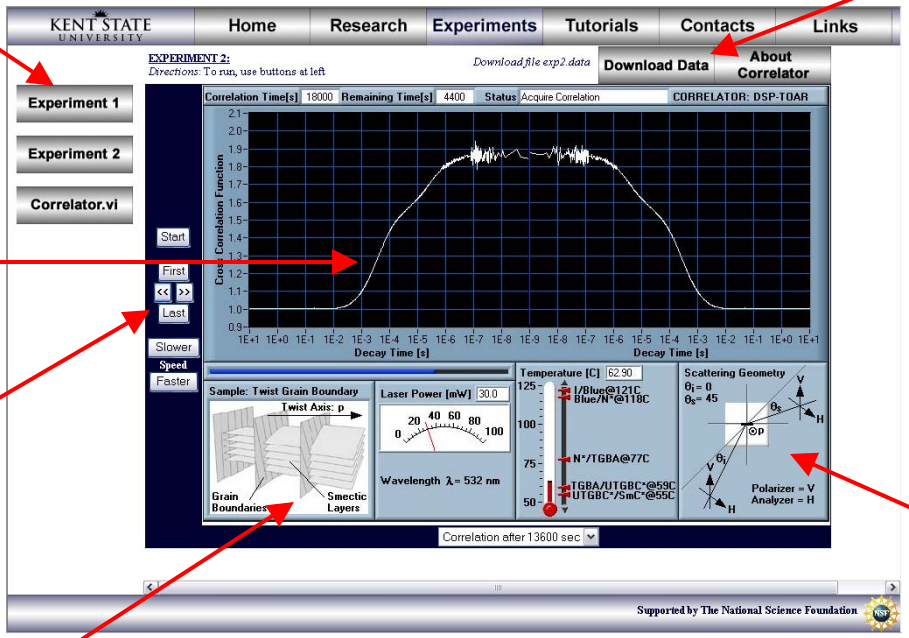
- Archived light scattering experiments designed for science education can be accessed and run interactively over the web on a 24/7 basis
- Realistic instrument feel and visual appeal through LabVIEW software
- Full implementation to include web control of live experiments
- Continuous pathway for technical improvement through partnership with National Instruments

Selection of different experiments to include scientific background and protocols for specific investigations

Graphical display of critical data continuously updated

Controls to acquire data or replay acquisition

Graphical description of relevant physical features of sample under study



Data downloadable as ascii file for remote analysis

Dual Cross Correlation

Correlation AxB BxA

Time[s] [a.u.] [a.u.]

1.00E-09 1.87E+00 1.89E+00
2.00E-09 1.87E+00 1.88E+00
3.00E-09 1.91E+00 1.89E+00
4.00E-09 1.90E+00 1.89E+00
5.00E-09 1.89E+00 1.86E+00
6.00E-09 1.88E+00 1.90E+00
7.00E-09 1.87E+00 1.91E+00

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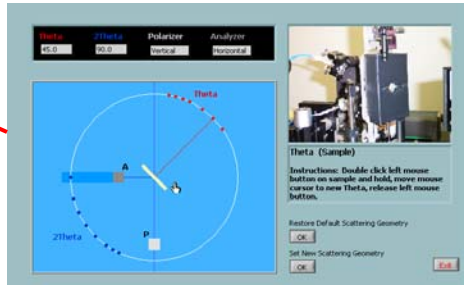

Intuitive graphical interfaces to adjust key experimental conditions such as the scattering geometry